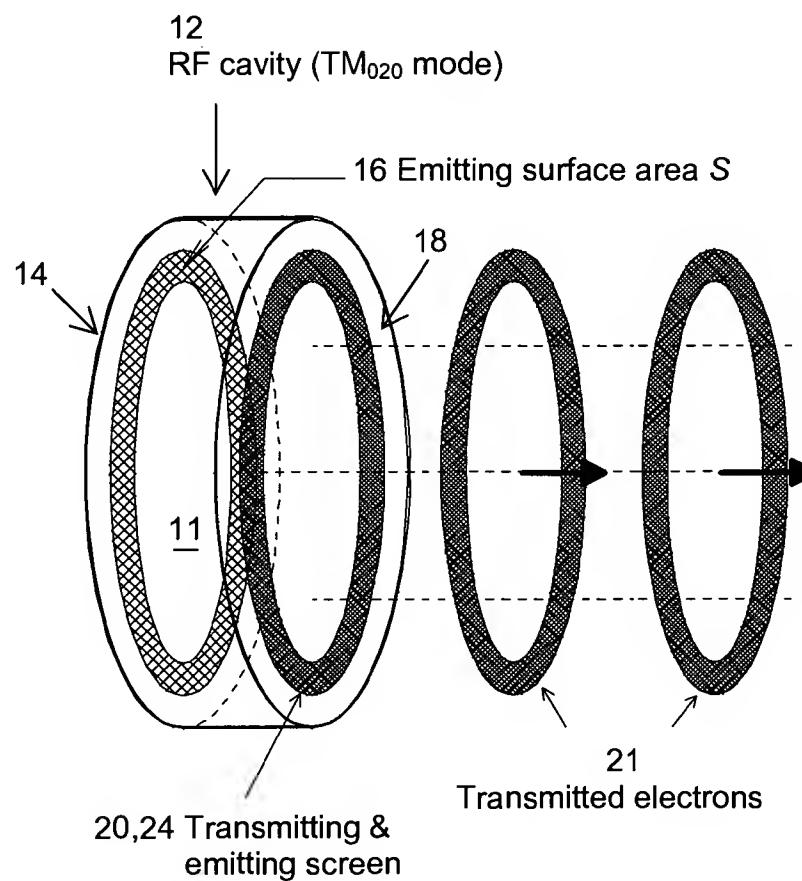




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22                    26                    10  
Oscillating means    Electric field means    Electron gun  
  
28                    Magnetic field means



11  
Electrons between 16 and 20

Figure 1: Perspective view of the micropulse gun for a hollow beam in the  $TM_{020}$  mode. The inner conductor is not shown.

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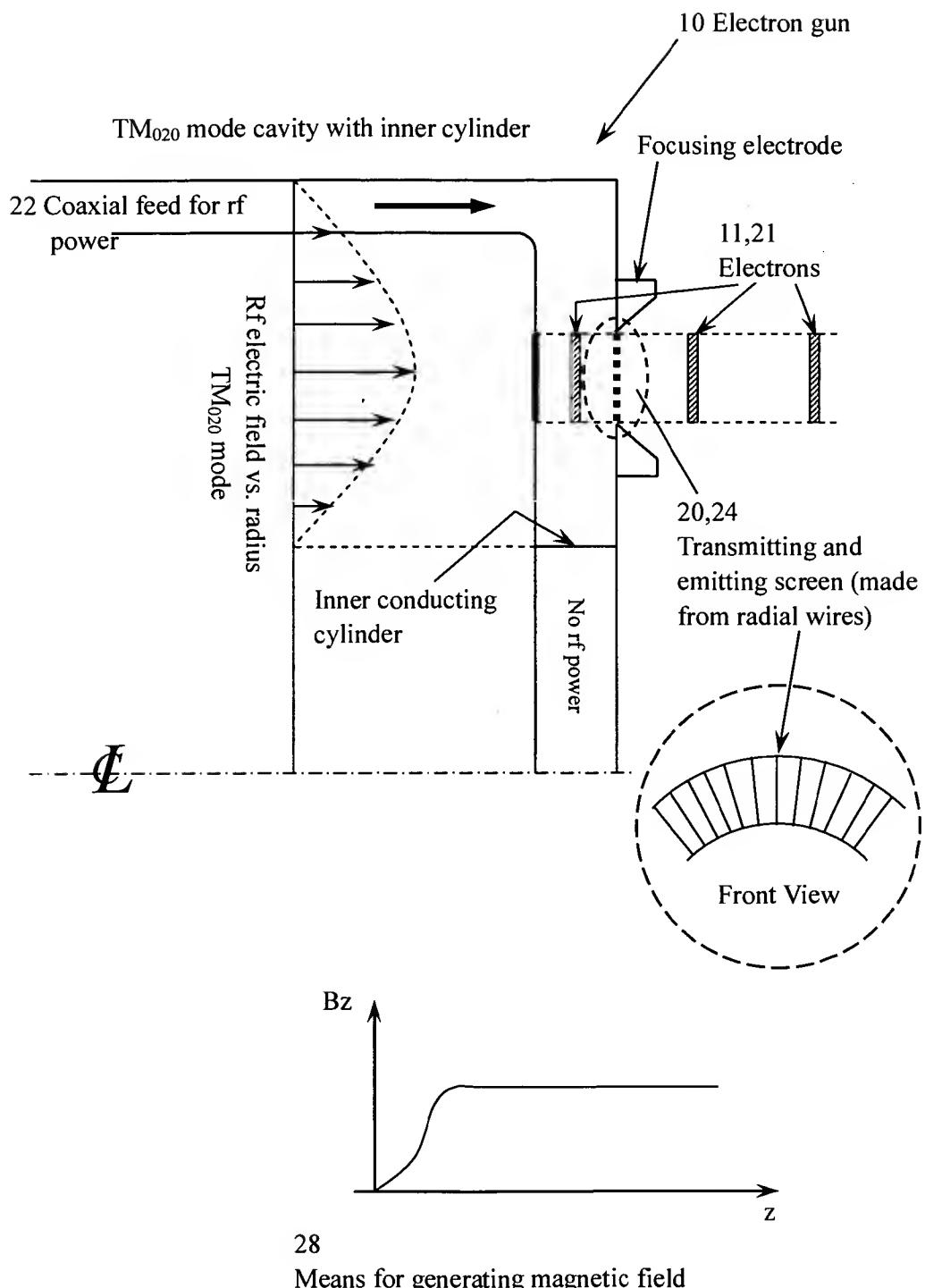


Figure 2: Schematic of rf gun operating in TM<sub>020</sub> mode.

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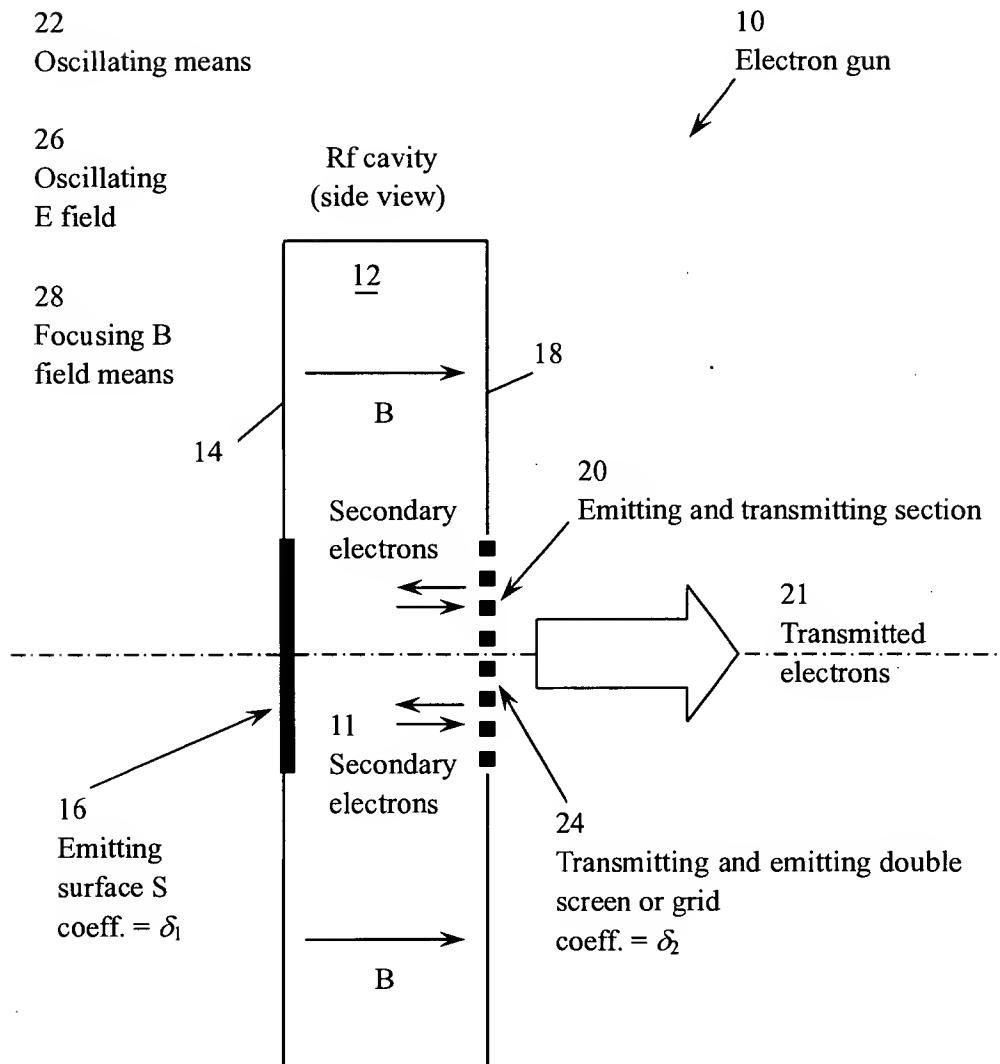
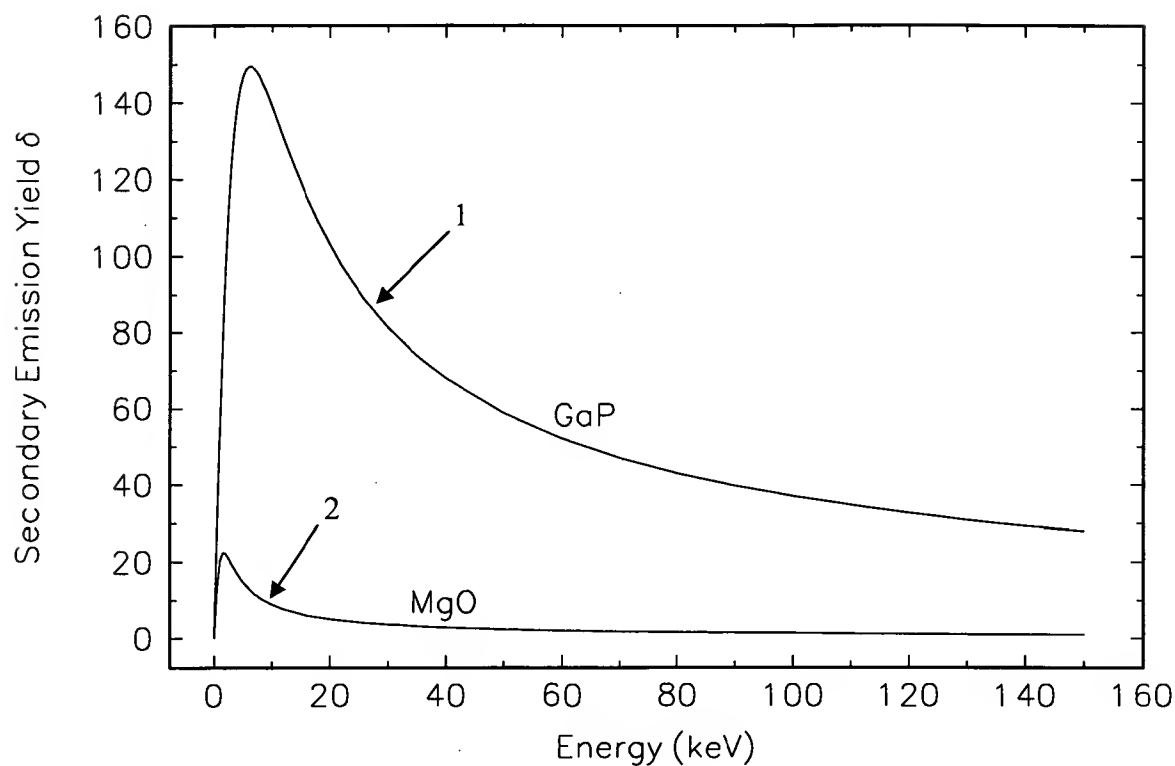


Figure 3: Schematic of micropulse gun for solid beam (TM<sub>010</sub>) mode. A coaxial feed is used for rf input (not shown).

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1 – Secondary emission yield of GaP  
2 – Secondary emission yield of MgO

Figure 4: Secondary electron emission yield curve for GaP and MgO.

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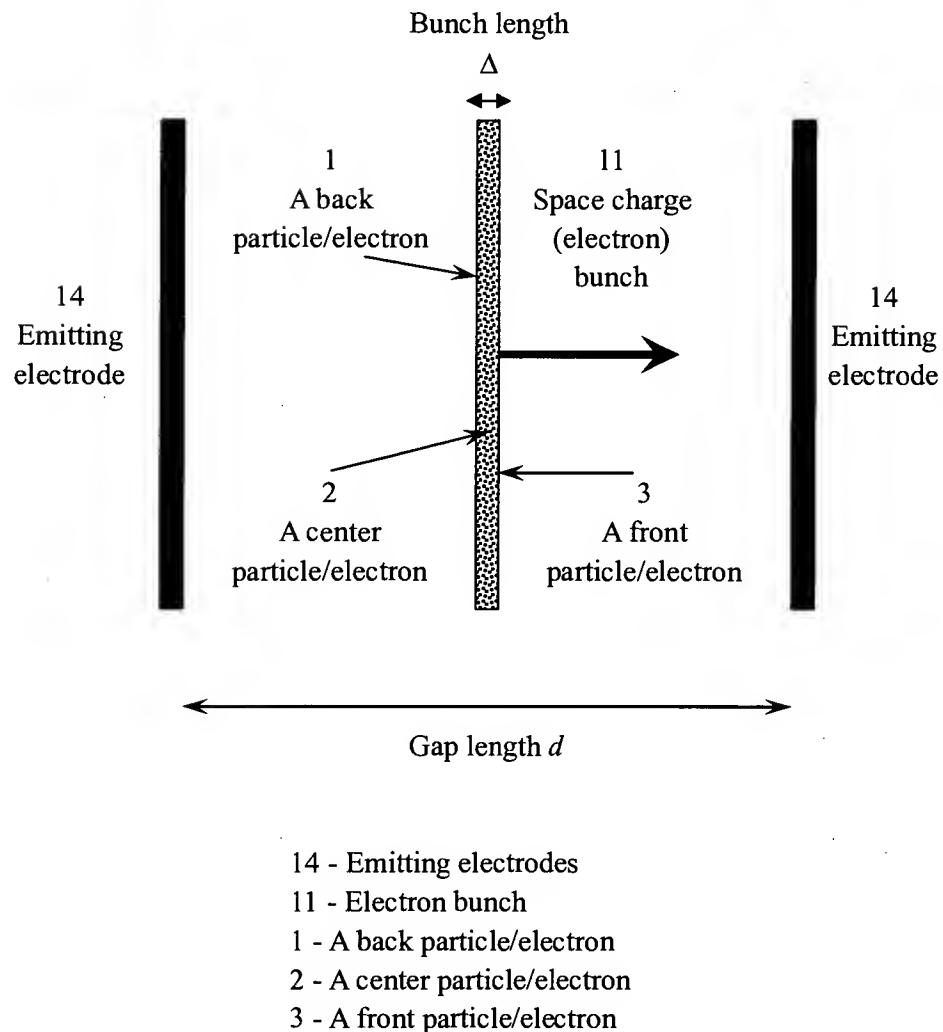
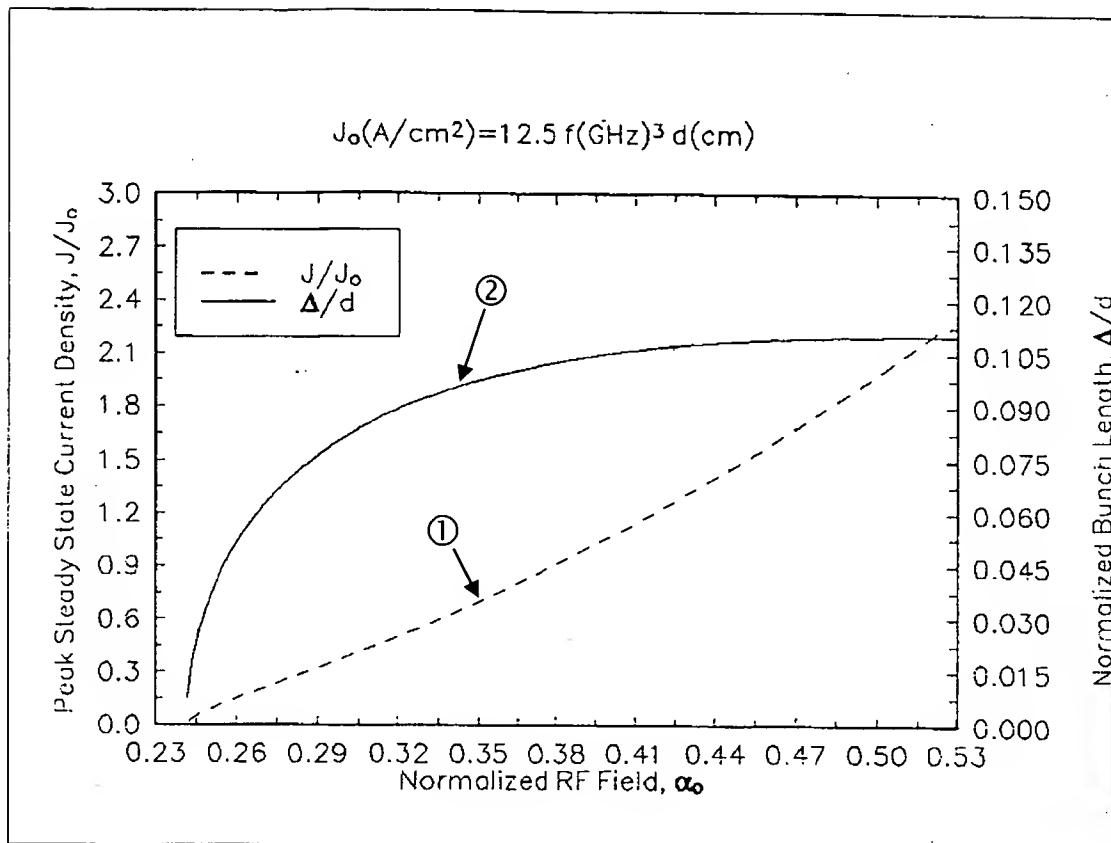


Figure 5. Schematic drawing of model used in theoretical analysis.

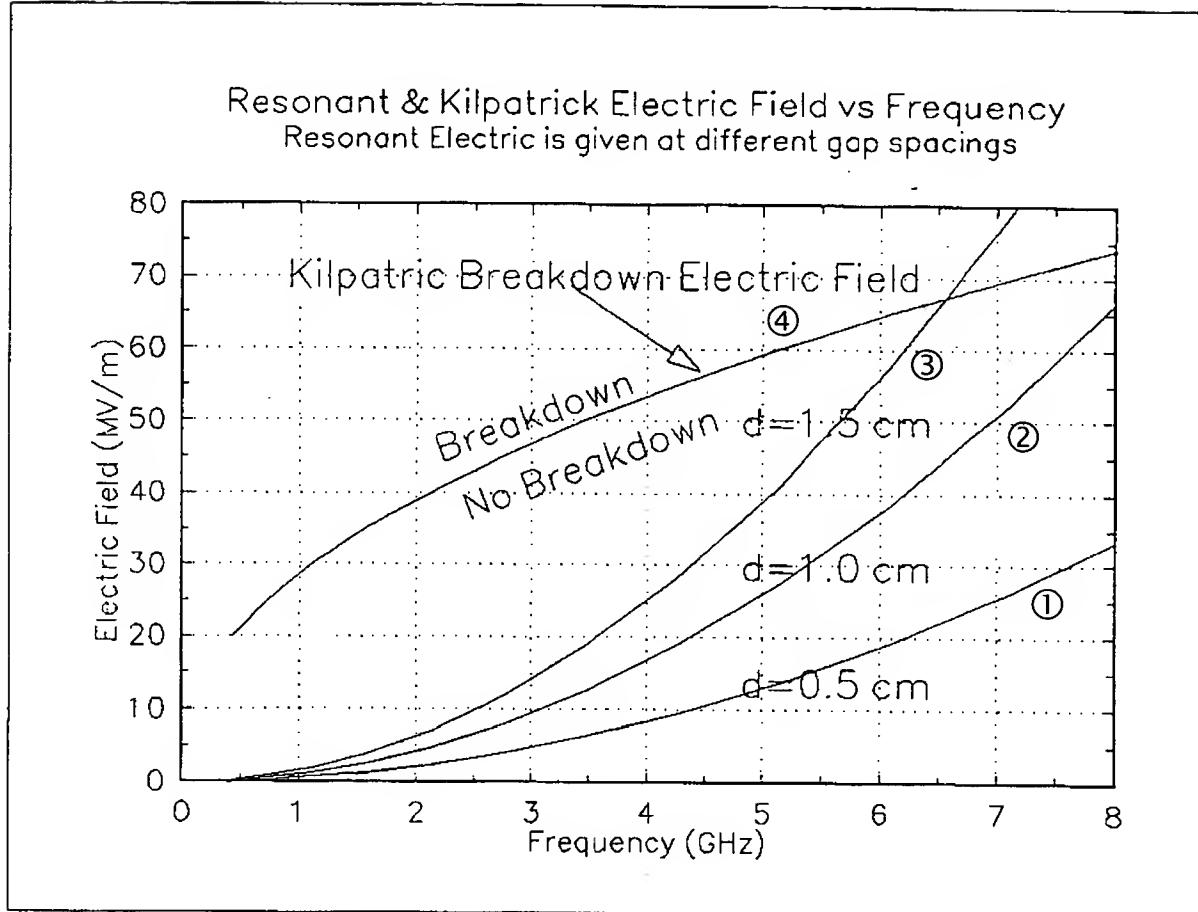
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- ① Plot of normalized peak current density at steady state versus rf field.
- ② Plot of normalized electron bunch length versus rf field.

Figure 6: Steady-state current density and bunch length vs. rf field, all parameters are normalized.

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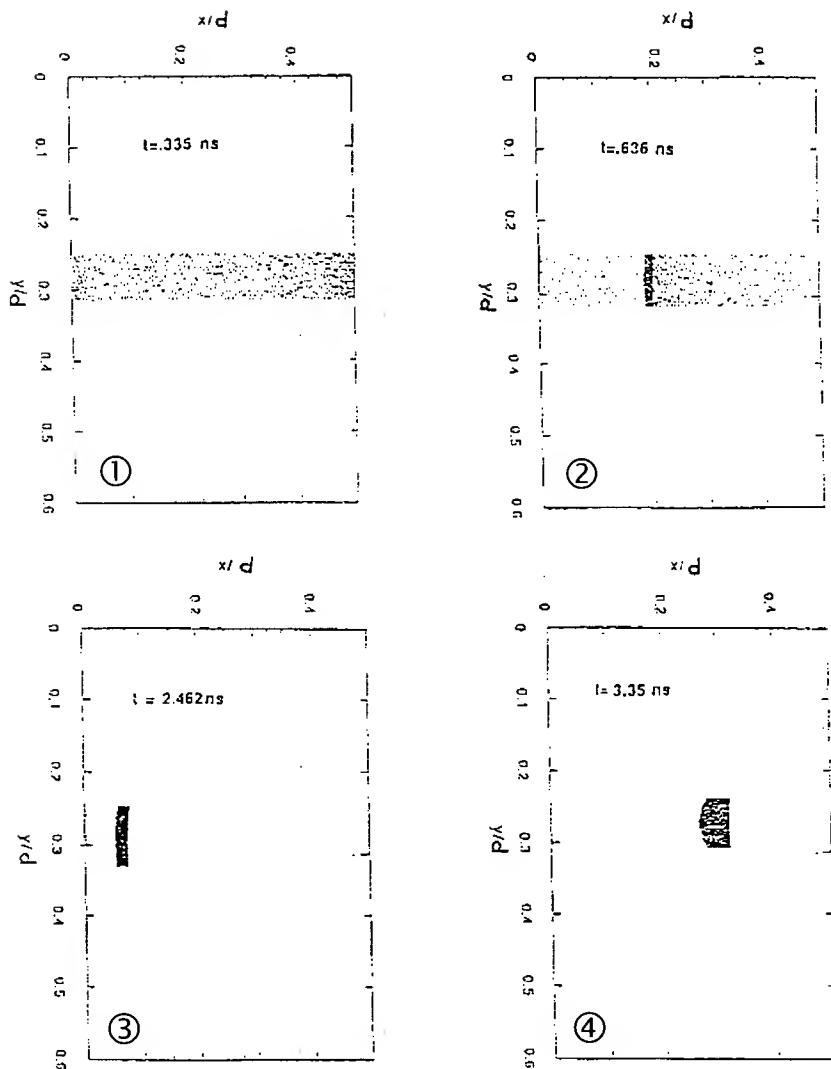


- ① Plot of resonant electric field versus frequency for 0.5 cm gap
- ② Plot of resonant electric field versus frequency for 1.0 cm gap
- ③ Plot of resonant electric field versus frequency for 1.5 cm gap
- ④ Plot of Kilpatrick breakdown electric field versus frequency.

Figure 7: Plot of resonant electric fields for  $\alpha_0 = 0.453$  and various gap spacings. Also shown is the critical Kilpatrick electric field as a function of rf frequency.

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## 1.3 GHz, xy plot



- ① Plot of electron distribution in the cavity at  $t = 0.335 \text{ ns}$ .
- ② Plot of electron distribution in the cavity at  $t = 0.636 \text{ ns}$ .
- ③ Plot of electron distribution in the cavity at  $t = 2.462 \text{ ns}$ .
- ④ Plot of electron distribution in the cavity at  $t = 3.35 \text{ ns}$ .

Figure 8: Series of time “snapshots” for a 1.3 GHz,  $d = 0.5 \text{ cm}$  cavity using the two-dimensional PIC code with secondary emission. Note the rapid particle build-up and bunching by phase selection. Electrons traverse the horizontal axis. On the vertical axis, emission is limited to the region 0.25 to 0.32 cm.

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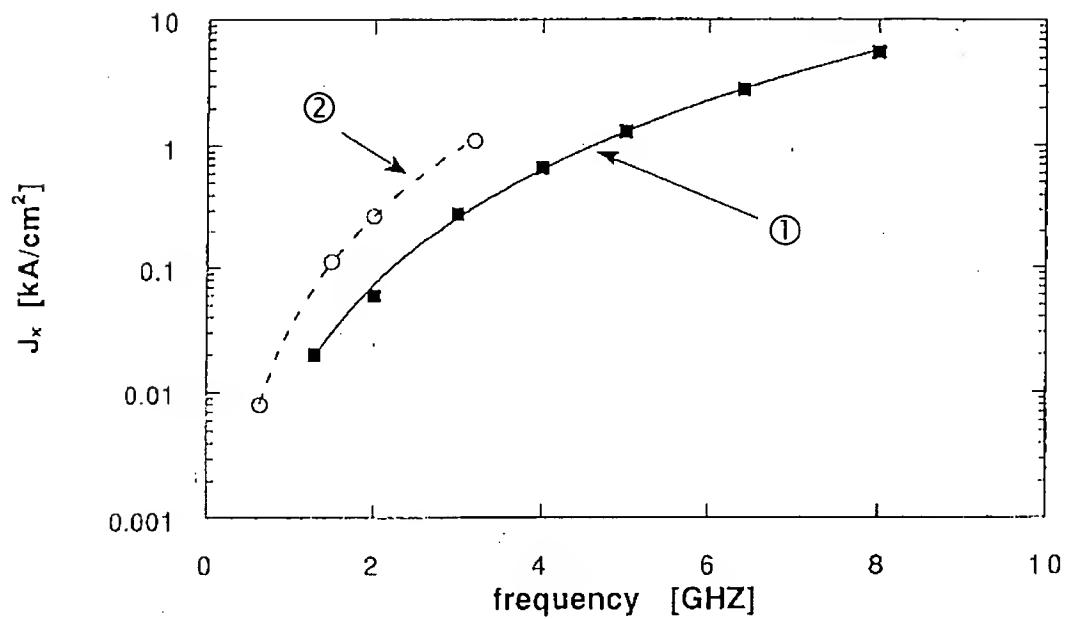
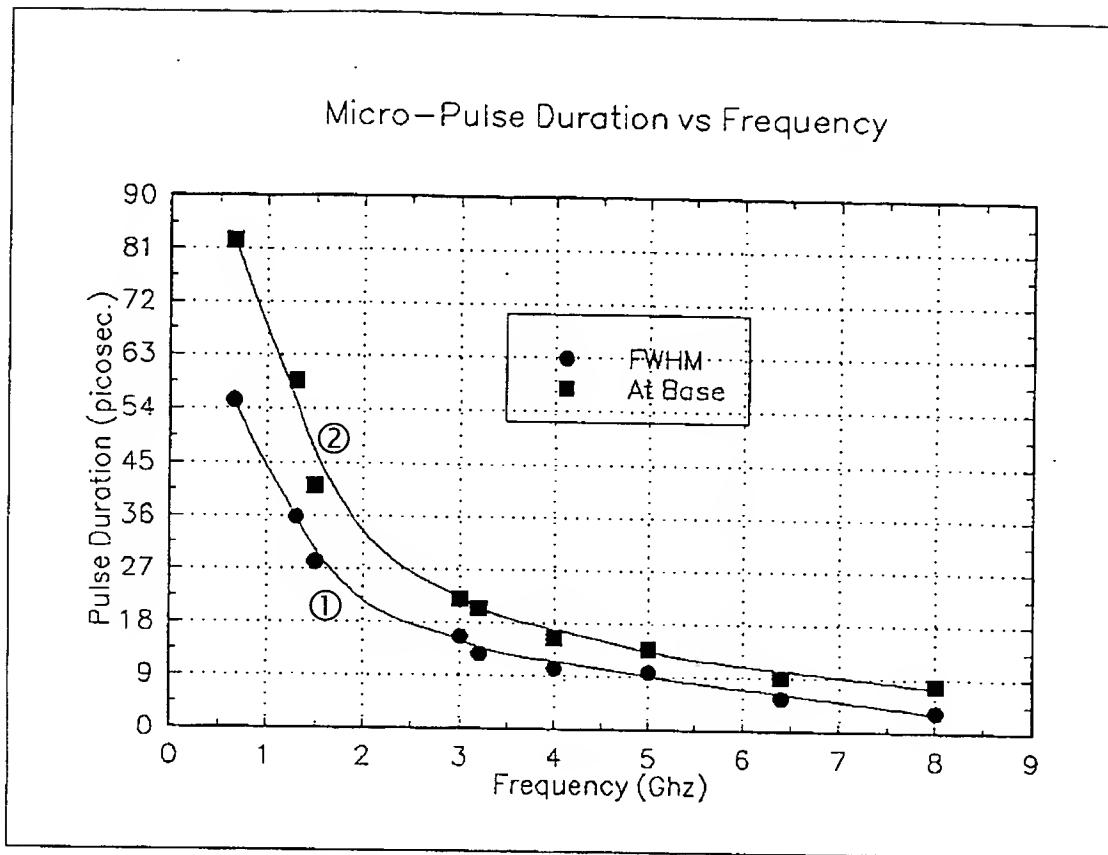


Figure 12: Steady-state current density vs. rf frequency for cavity with  $\alpha_0 = 0.453$  and gap lengths of ① 0.5 cm (solid line is a fit using  $J_x = 0.008f^{3.15}$ ) and ② 1.0 cm (dashed line is a fit using  $J_x = 0.03f^{3.1}$ ).

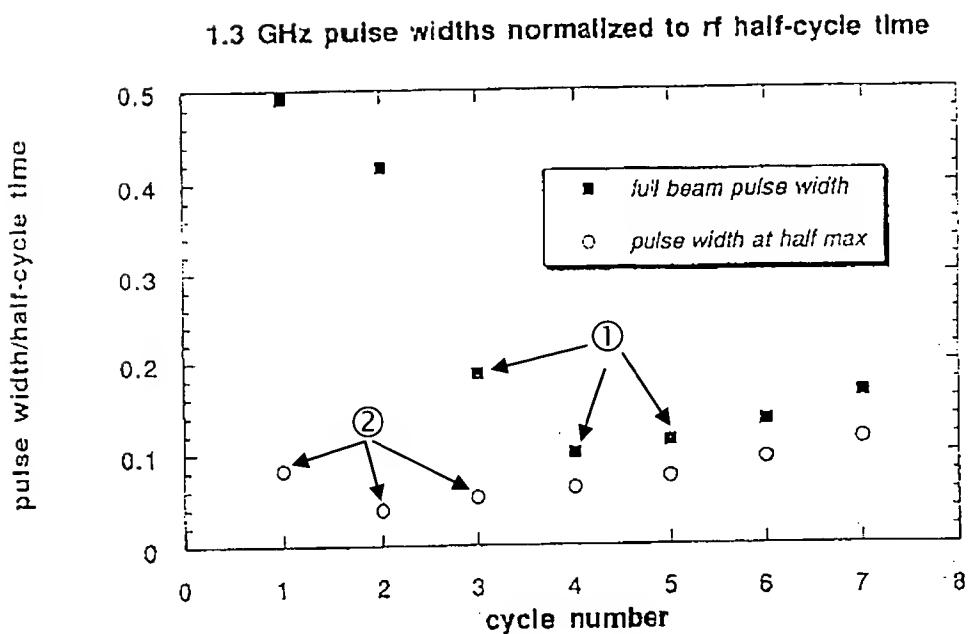
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① Electron micro-pulse full width at half maximum.  
② Electron micro-pulse full width at the base of the pulse.

Figure 13: Micro-pulse duration vs. frequency for  $\alpha_0 = 0.453$ .

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- ① (solid square) Beam full width at different rf cycle.
- ② (open circle) Beam full width at half maximum at different rf cycle.

Figure 14: Micro-pulse width (as a fraction of the half-cycle) vs. rf cycle number near the output grid. The full beam pulse width decreases with time, and reaches a minimum at the fourth rf cycle. After saturation there is a slight increase in pulse-width due to space-charge effects.

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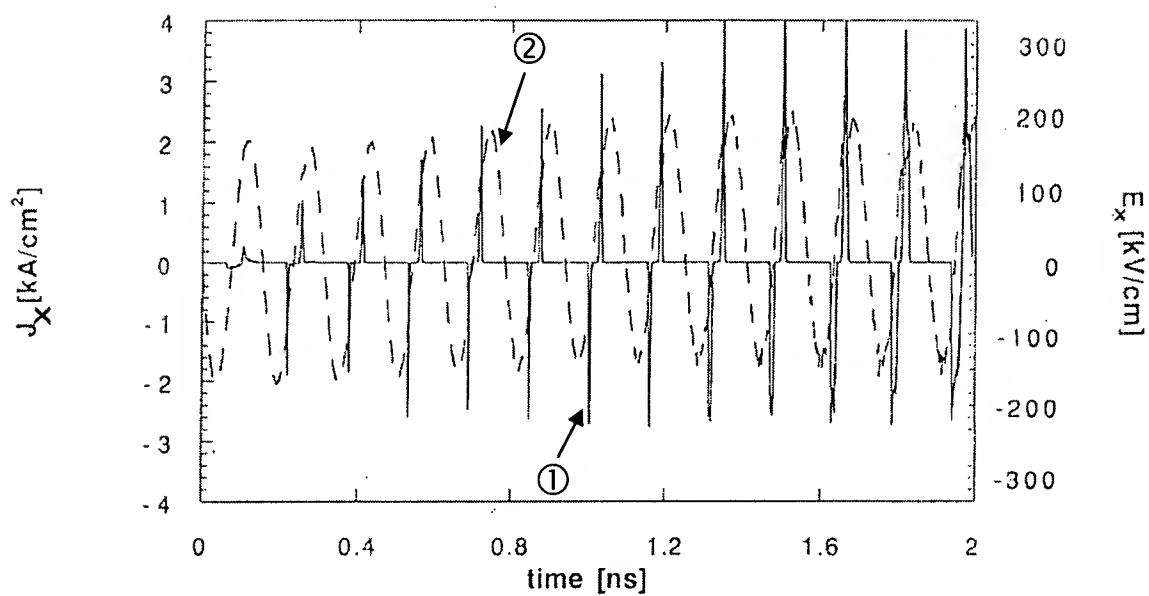


Figure 16: ① Plot of the current density in  $\text{kA}/\text{cm}^2$  (solid line) and ② the longitudinal electric field (dashed line) for the 6.4 GHz, 105 kV simulation.

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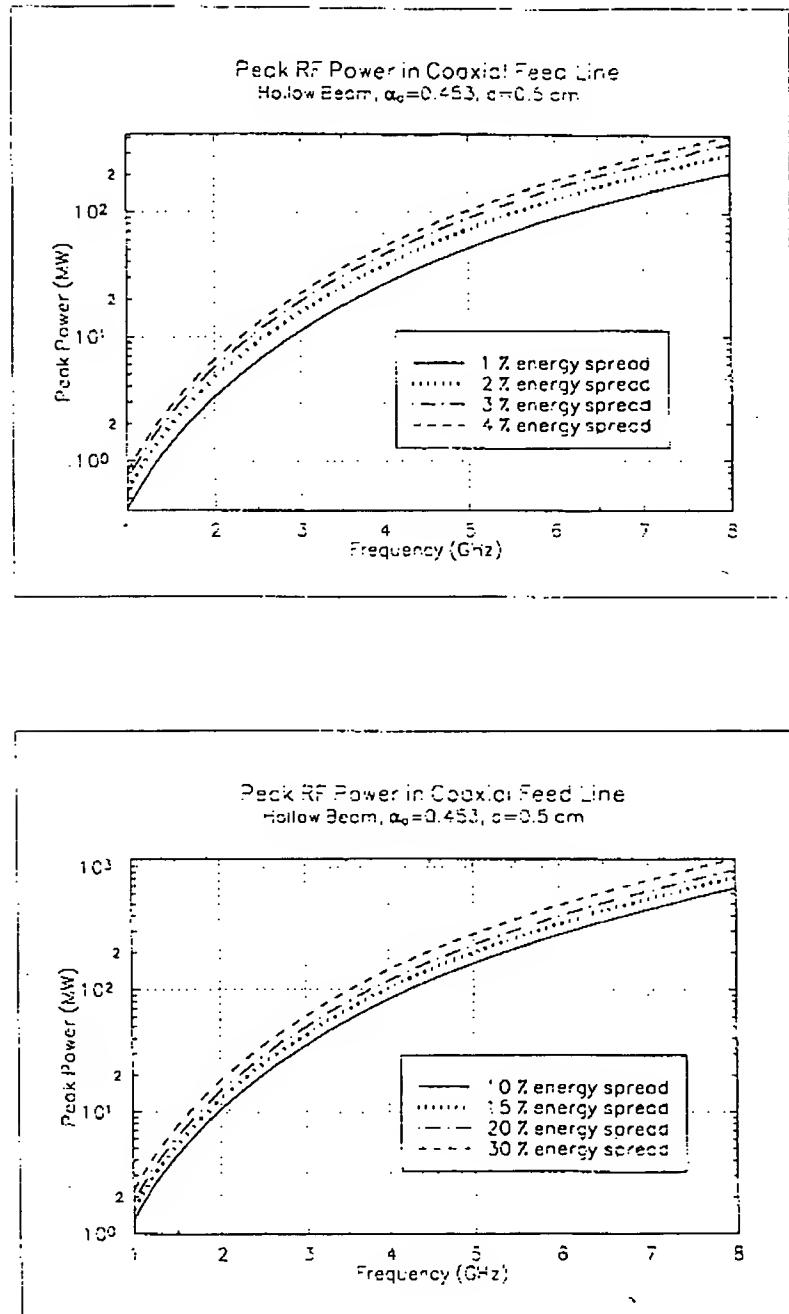


Figure 43: Peak rf power in coaxial feed line for a hollow beam,  $d = 0.5$  cm.

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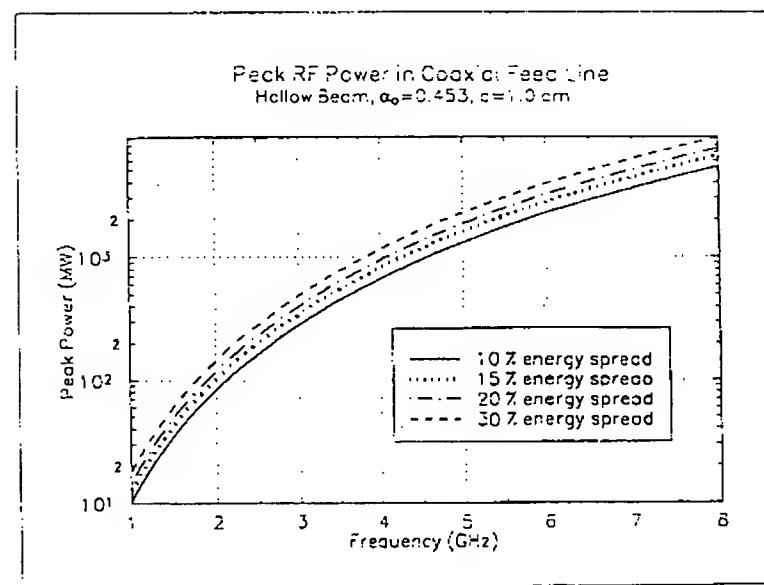
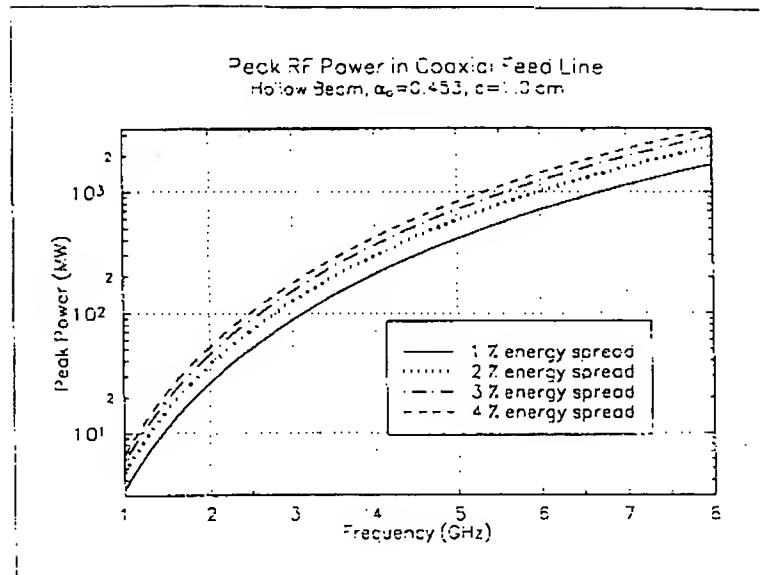


Figure 44: Peak rf power in coaxial feed line for a hollow beam,  $d = 1.0$  cm.

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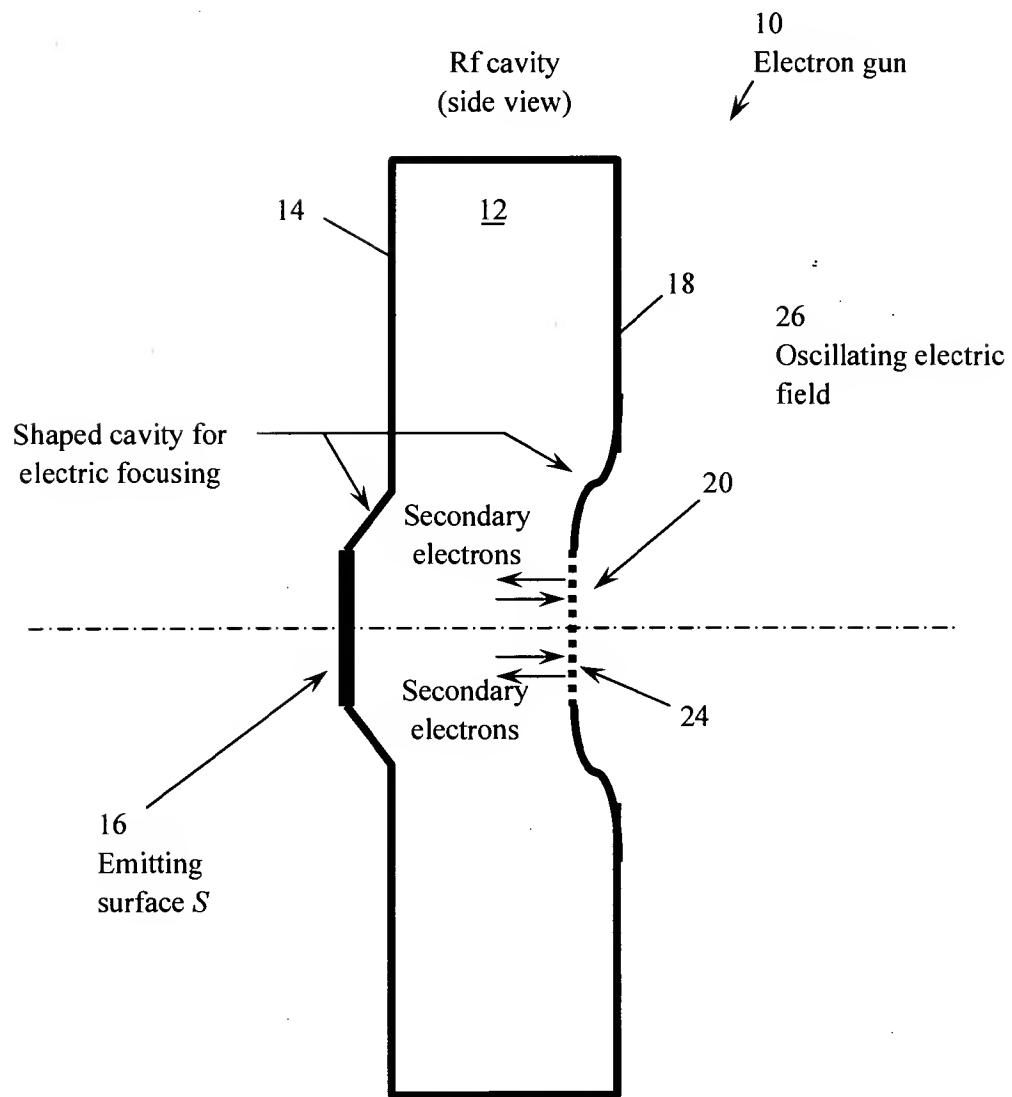


Figure 46: Schematic drawing of a possible design for electrostatic focusing in the MPG.

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